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Inventory management and cost efficiency: A case study in medical devices distributor

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ABSTRACT

This research aims to observe current inventory management applied by one of the medical equipment distributors specializing in eye health devices, and provide recommendations for an optimal inventory management system to achieve cost efficiency afterward. The method used in this research is quantitative, focusing on processing and analyzing numerical data obtained from the company to calculate safety stock and the number of orders. In addition, ABC classification is also used in data processing to group items based on their value. Items belonging to class A (having a value of 80% for the company) will be used in the data processing. The next step is to conduct forecasting simulations for demand forecasts. The results of the forecast will be used for calculating the safety stock and order quantity. The output from the results of data processing and analysis in this study shows 67 items included in class A, which will then be processed using Minitab software for forecasting. Based on comparing the four forecasting methods, the one with the lowest error value is Trend Analysis. If the company can apply the storage method according to the fixed-time period model calculation, there is a potential savings of US $ 717,133 or 63% of the total overstock.

Introduction

Today's globalizing world is facing an aging population. In the coming years, rising life expectancy and declining birth rates will generate opportunities and challenges for the global healthcare industry. Demographic shifts and changes in daily consumption preferences would seriously impact the market for both healthcare and medical devices. As a country with more than 260 million inhabitants in 2019, Indonesia has aging people (age more than 65 years old) as much as 17.4 million or nearly 7% of the total population. The growth of the elderly population will have a huge economic and societal impact, especially in the healthcare sector. As central and regional governments continue to build and upgrade healthcare facilities; thus, healthcare is a priority on the national development agenda. Indonesia's progress towards achieving Sustainable Development Goals (SDGs), which strive to raise overall living standards by improving human resources, is one way to take a closer look at the healthcare system's efficiency. The implementation of universal healthcare programs has increased healthcare access and hence, demand for hospitals, clinics, doctors, and medical equipment.

Medical devices are an important component in health workers and medicines in health service facilities. Medical device technology is developing rapidly in line with information technology development, which is being used in healthcare facilities and households. Based on the Ministry of Health, as much as 92% of medical devices are still imported mostly from China, India, Europe, and United States. Limited raw materials and manufacturers' capabilities become the main reason for importing. As a result, distributors of medical devices take the major players to fulfill domestic needs.

As the demand for imports of medical devices is growing every year, and there are still high needs for health workers, especially in the eye health field, it makes distributors a key player to meet domestic needs. Usually, distributors make a purchase of medical products in a bulk system to fulfill customer demand optimally and attempt not to encounter supply shortages and efforts to do cost efficiency. A risk that may arise from the extensive quantities purchasing process concerns the build-up of materials in the warehouse. The purchase amount is critical to be adjusted with the limit of warehouse capacity not to exceed the stock. Overstock can lead to the

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maintenance of items in the warehouse become nonoptimal and can degrade the items' quality. Moreover, medical equipment has strict standards for its storage system and maintenance to keep the safety and quality in use.

Several studies related with the inventory management in pharmaceutical industries and health facilities (hospitals and clinics) conducted by Al-Qatawneh (2011) that uses a multi-criteria inventory classification in hospitals that aims to optimize costs in inventory control. Çalışkan, C. (2020) developed an Economic Order Quantity (EOQ) formula for deteriorating items (food and medicine) which provides an optimal solution for inventory levels. Meanwhile, the review conducted by Gonçalves, et al. (2020) stated that determining safety stock in inventory management is crucial for dealing with demand uncertainty and preventing inventory stockouts. Hafnika, et al. (2016) conducted an application research of continuous review policy as inventory management in a hospital in Bandung, Indonesia. The results obtained from Hafnika (2016) that there is a reduction in costs of more than 50% due to overstocked inventory at the hospital.

PT. Medica Utama is one of the distributors specifically for eye treatment medical devices. The company carries out consumer goods by import, where currently the significant suppliers are from India and China. PT. Medica Utama has more than a hundred types of products. has applied a proper method for inventory review that conduct once per three months. This is an effective method for large quantities that require spare time for delivery (lead time) since all items are imported. As long as the review period is executed regularly, it is hoped that there are no major problems related to the availability of stock item. Unfortunately, the company does not yet have an inventory control model related to the calculation of safety stock and the number of orders. Currently, this calculation is done manually by the owner by review the historical data. This method has a low level of accuracy so that some items become the excess stock in the warehouse, and some are not available when there is a request from a customer (loss sales).

The inventory management system is one of the essential things that must be considered by a business engaged in the distribution area. System implemented by PT. Medica Utama using estimates based on historical data has many shortcomings. In this case, improper and inaccurate of the order quantity and safety stock can be considered the secondary cause of the inventory management problem. By looking for the right calculation method, the problem determining the amount of safety stock and order quantity can be resolved. It is expected to increase the efficiency of ordering costs.

This research aims to observe current inventory management applied by PT. Medica Utama and related problem. Evaluate the effectiveness of the existing method by looking at the stock condition in the Jakarta warehouse. The outcome of this research is to provide recommendations for an optimal inventory management system to achieve cost efficiency.

There are several limitations in this study, which are only a few critical items obtained from the classification result (class A items) will further be processed on the analysis part; the improvement plan is only for internal evaluation without any reference to the market competition (no competitor taken into account); the analysis is assuming that the projection did not include the potential of having Covid-19 Pandemic in 2020; methodology is only limited to secondary data obtained from the company’s database.

Literature Review

Theoretical and Conceptual Background

ABC Classification

Ensuring accuracy in inventory records is essential to running an efficient inventory control process. One of techniques that is often used is ABC analysis. ABC inventory classification scheme divides inventory items into three grouping: high dollar volume (A), moderate dollar volume (B), and low dollar volume (C). Dollar volume is a measure of importance, an item with low cost but in high volume can be more important than a high-cost item with low volume (Jacob and Chase, 2018). Traditional ABC classification, which uses annual dollar volume to grouping items, is considered an easy way to use yet can create inefficiencies in inventory management. Simply considering total value as criteria can lead to inappropriate decisions on inventory items classification (Millstein, et al. 2014).

Multi-criteria inventory classification (MCIC) is a method that considers several criteria in determining the class of inventory items. This method can provide an alternative criterion where criteria other than the total value of goods are also considered important in classification. Unit cost and lead time can be considered as important components in making this decision (Pratomo, 2019).

Forecasting

Time Series

As stated by Jacobs and Chase, time series models aim to predict the future based on historical results. In general, short-term projections are used for operational decisions such as near-term product replenishment or staff scheduling. The medium-term forecast is used to prepare a demand-meeting approach over the next six months to a year a half. Choosing an appropriate forecasting model is depends on several factors such as time horizon to forecast, data availability, accuracy required, size of forecasting budget, and availability of qualified personnel (Jacobs and Chase, 2018).

Exponential Smoothing

Exponential smoothing is the most used forecasting technique in ordering inventory in retail firms, wholesale companies, and service agencies (Jacobs and Chase, 2018). It is a time series forecasting technique using weights that decrease exponentially (1 - α) for each past period. Smoothing constant alpha (α) as the exponential smoothing parameter that governs the speed of response to forecast discrepancies and real demand. Equation for single exponential smoothing forecast is following:

$$F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$$

Where:

F_t = The exponentially smoothed forecast for period *t*

F_{t-1} = The exponentially smoothed forecast made for the prior period

A_{t-1} = The actual demand in the prior period

α = The desired response rate or smoothing constant

Moving Average

The purpose of the forecast is to determine the forecast period length used by the firm. If the firm needs a demand forecast for the medium-term planning budget, then the monthly period will be more appropriate. At the same time, the weekly forecast is for short-term decisions related to the inventory replenishment. Forecast period numbers also give big effect in the forecast accuracy even though the moving average period selection is also important. As the moving average period is shorter, the period used will be less, and there will be more oscillations, so there is a tendency to follow the trend more. Conversely, a longer time span will give a smoother response, but a sizeable gap from the trend. The formula for a simple moving average is:

$$F_t = \frac{A_{t-1} + A_{t-2} + A_{t-3} + \ldots + A_{t-n}}{n}$$

Where:

F_t = Forecast for the coming period

n = Number of periods to be averaged

A_{t-1} = Actual occurrence in the past period

A_{t-2}, A_{t-3}, and A_{t-n} = Actual occurrences two periods ago, three periods ago, and so on, up to *n* periods ago

Forecast Error

When the term forecast error is used, it refers to the difference between what really happened and what was expected. These faults are called residuals in statistics. Demand for a commodity is created by the interaction of a variety of variables that are too complex to precisely represent in a model. Therefore, surely all predictions involve an error. Mean Absolute Deviation (MAD) is the average error in the forecasts, using absolute values. It is valuable because MAD, like the standard deviation, measure the dispersion of some observed value from some expected value. MAD equation is as follows:

$$MAD = \frac{\sum_{t=1}^{n} |A_t - F_t|}{n}$$

Where:

t = Period number

A_t = Actual demand for the period *t*

F_t = Forecast demand for the period *t*

n = Total number of periods

An additional measure of error that is often useful is the Mean Absolute Percent Error (MAPE) which measure gauges the error relative to the demand as a percentage. MAPE is calculated as follows:

$$MAPE = \frac{100}{n} \sum_{t=1}^{n} \left[\frac{|A_t - F_t|}{A_t} \right]$$

Inventory Management (Fixed-time Period Model)

According to Jacob and Chase (2018), in a fix-time period model, inventory is counted only at particular times, either every week or every month. In case such as when retailers make regular visit to customers and collect orders for their entire product range, or when buyers wish to merge orders to save shipping costs, inventory counting and placing orders periodically are desirable. Based on the consumption rate, fixed-time period models generate order quantities that vary from period to period. This typically require a higher safety stock level than a fixed-order quantity model.

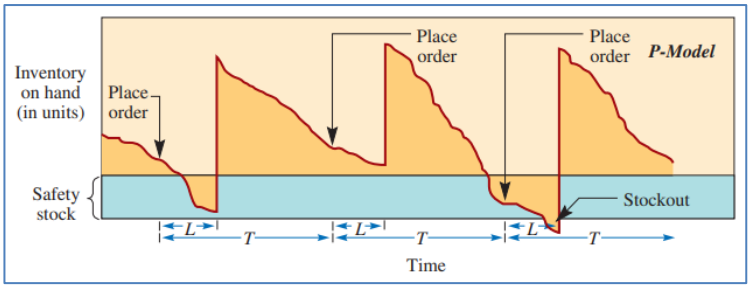

Figure 1: Fixed-Time Period Inventory Model: *Source: Jacobs and Chase (2018), Operations and Supply Chain Management*

Periodic inventory tracking is necessary in this model, and order placement will be done when the inventory level reach reorder point. The organization can deal with stock out as the demand condition could go up rapidly without noticing inventory level until the next tracking. Safety stock must protect against stock outs during the review period, *T*, as well as during the lead time, *L*, from order placement to order receipt. In this case, demand is randomly distributed about a mean *d*. Then the quantity to order for the fixed-time period model is:

$$q = \bar{d}(T + L) + z\sigma_{T+L} - I$$

Where:

q = Quantity to be ordered

T = The number of days between reviews

L = Lead time in days (time between placing an order and receiving it)

$\bar{d}$ = Forecast average daily demand

z = Number of standard deviations for a specified service probability

σ_{T+L}= Standard deviation of demand over the review and lead time

I = Current inventory level (includes items on order)

In order to meet customer demand, the amount of stock of goods in the warehouse must also be considered, where determining the minimum stock (safety stock) is an essential factor in maintaining the availability of goods. Safety stock can be defined as the amount of inventory carried in addition to the expected demand (Jacob and Chase, 2018). This can be identified as a *mean* in normal distribution. Typical approach for safety stock is a certain number of weeks of supply needs to be kept in a company, even though it is better to use an approach that captures the variability in demand. As stated by Gonçalves, et al. (2020), in inventory management, safety stocks are a suitable strategy to deal with demand and supply uncertainty aiming to prevent inventory stock-outs. Safety stocks are essentially affected by six factors, including service level, lead time, demand volatility, order policy, component commonality, and holding cost (Gonçalves et al., 2020). An optimal safety stock strategy should be small enough to reduce inventory-related costs while satisfying demand and high service level customers on time. Since fixed-time period model have reviewing time for inventory, *T*, where order was placed, safety stock that must be available is:

$$SS = z\sigma_{T+L}$$

Standard deviation of demand over the review and lead time T+L is the square root of the sum of the variance for each day:

$$\sigma_{T+L} = \sqrt{\sum_{i=1}^{T+L} \sigma_d^2}$$

Because each day is independent and σ_d is constant, therefore:

$$\sigma_{T+L} = \sqrt{(T+L)\sigma_d^2}$$

For a given likelihood of stocking out in the fixed-order quantity model and fixed-time period model, both have equations for measuring the safety stock required. In all versions, believe that half of the time, it needs to use safety stock while going on order point, and half time it does not. Thus, on average, the safety stock *SS* was supposed to be on hand. In the fixed-time period model, how many units are supposed to be ordered each period needs to be determined. If demand is believed to remain reasonably constant, the number of units anticipated to be in demand over the review period may be expected to be ordered. The expected demand is equal to *dT* if use assumption of there is no trend or seasonality in the demand pattern.

$$Average\ inventory = \frac{dT}{2} + SS$$

Conceptual Framework

Information gathering will be done through an interview process with the business owner. Several outputs from the interview, including material distribution flow, start from ordering items until delivering products to customers, existing system for inventory management applied by the organization, and the list of branch offices and customers' list. Based on the information gathered and did some literature review, the problem can be identified. Afterward, collecting secondary data from the company's database, such as the list of materials purchased and sold in one year and data for expired items in the Jakarta warehouse.

The company has a large number of materials. Thus, only items that have high value will be used in the analysis and calculation process. The usage of the ABC classification method will examine a list of high-value items. After getting the specific numbers of things, the next step is doing forecasting for next month's demand. From several forecasting methods, one method that has the smallest error value will be selected. An appropriate inventory management model is chosen according to the company's conditions after getting the demand forecast results. Then the ordering quantity and safety stock will be calculated based on the selected model. Following all calculations' results, the last step is to develop solutions by comparing the previous system with alternative suggestions based on research exploration.

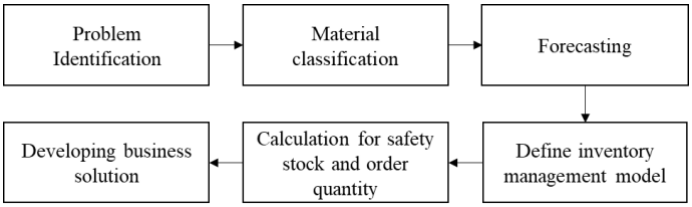

Figure 2: Research Conceptual Framework

Empirical Review and Hypothesis Development

The ABC classification model in inventory management is applied to several companies engaged in pharmaceuticals and medical devices. In a study conducted by Pratomo (2019), it is stated that the Multi-Criteria classification model is commonly used by companies that manage large inventories. Pratomo (2018) compared several inventory management methods, such as the traditional ABC model, the Ng ABC classification model, and the Ramanathan model, in a chemical manufacturing company. The classification results can be used to determine inventory control policies, namely continuous (daily) review for class A, periodic review for class B, and occasional review for items in class C.

Pharmaceutical distributors in Kuwait also implement the ABC classification method. As stated in the study of Nag, et al. (2020), by combining the ABC and VED analysis (vital, essential, desirable) to divide the inventory into three categories, namely category I (vital and costly), category II (moderate control), and category III (low control). This inventory classification aims to determine purchasing decisions, prepare buffer stock, and reduce the possibility of out-of-stock so that resource use is optimal.

Apart from the chemical industry and pharmaceutical distributors, managing drug supplies in hospitals also uses a similar classification system. Mahendrawathi, et al. (2011) used a combination of ABC classification and fuzzy logic to classify drugs based on annual dollar usage and the importance of drug availability for patients (how big is the effect of drug unavailability on patient safety).

Based on previous studies mentioned above, it can be concluded that the ABC classification method is one of the appropriate methods to be applied to the health sector, especially drugs and medical devices. This classification method is an initial stage in inventory management which is then followed by determining the quantity and period of ordering.

Research and Methodology

The method used in this research is quantitative research since it focuses on processing and analyzing numerical data obtained from the company. Since the organization management is decentralized, this research will analyze the inventory management system only in Jakarta Head Office by suggesting an ordering method. The data will be processed statistically by applying the ABC classification theory for grouping items based on value. Only a few critical items, which obtained from the classification result (class A items), will further be processed on the analysis part.

Sort listed items included in classification A will make a demand prediction before calculating the safety stock and order quantity based on the inventory management model's theory. This study's quantitative data is historical demand data for 20 months from January 2019 to August 2020. Forecasting will predict September demand, and the next period for inventory review (which held in September) will be based on calculation result from this research.

Empirical Data and Analysis

Demand Trend

PT. Medica Utama has several items ordered regularly every year (called regular products). However, the owner still has difficulty calculating the number of orders and predicting future product demand. The demand trend during 2019 and mid-2020 can be seen in Figure 2. As the chart below, product demand is fluctuating each month. Usually, towards the end of the year, there will be a surge in product requests from government-owned hospitals (RSUD) due to budget exhaustion. Companies cannot always fulfill all those product requests because PT Medica Utama should also consider the condition of supplies in the main warehouse (Jakarta) and branch warehouse. Besides, PT Medica Utama also anticipates if other customers request the same products.

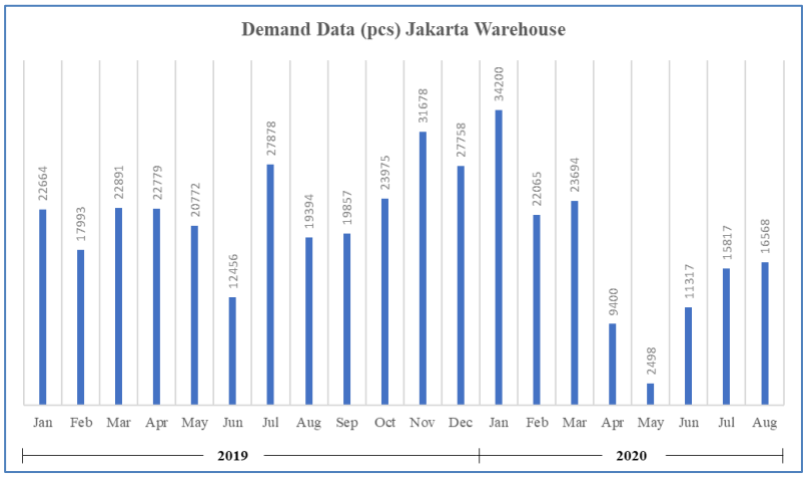

Figure 2: Demand Trend in 2019-2020 for Jakarta Area

Adding inventory in anticipation of a surge in demand can result in excess stock in the warehouse. This excess stock can be stored for a long time until the product reaches its expiration date. Data on the percentage of expired items is obtained from the number of expired items multiplied by its unit price (which can be considered the item value) compared with the Jakarta warehouse's inventory amount. As a result, there are 1.3% expired items (USD 15,170) from 2019 until mid-2020 from the total inventory value (USD 1,197,650). Even though the percentage of expired goods can be categorized as low, it can still be minimized using proper inventory management and choosing a forecasting method to predict future demand to provide a better view of ordering the right quantity of items.

The number of requests throughout the period January 2019 to August 2020 is very volatile. At the beginning and the end of the year, demand tends to be higher than in the middle of the year (April - August period). In April and May 2020, demand fell significantly due to the Covid-19 Pandemic, however it began to increase in June to August.

Problem Root Cause

A Tree Diagram is used to find out the company's problem and determine the root cause. Currently, the problem is often faced by PT. Medica Utama is related to the inventory management system, such as out of stock material (backorder) and overstock problem. Based on an interview with the owner, several factors have caused backorder and overstock, including delivery delays, flawed

inventory management system, unpredicted high demand, and product expired/damaged. These four factors are the primary cause of the out-of-stock problem. For delivery delays, the secondary cause is a problem from the supplier side. Constraints from the supplier are usually related to the item's availability or delays in delivery due to the weather conditions (for shipments by sea). Supplier-related problem is an uncontrollable condition for the company, because it is an external factor.

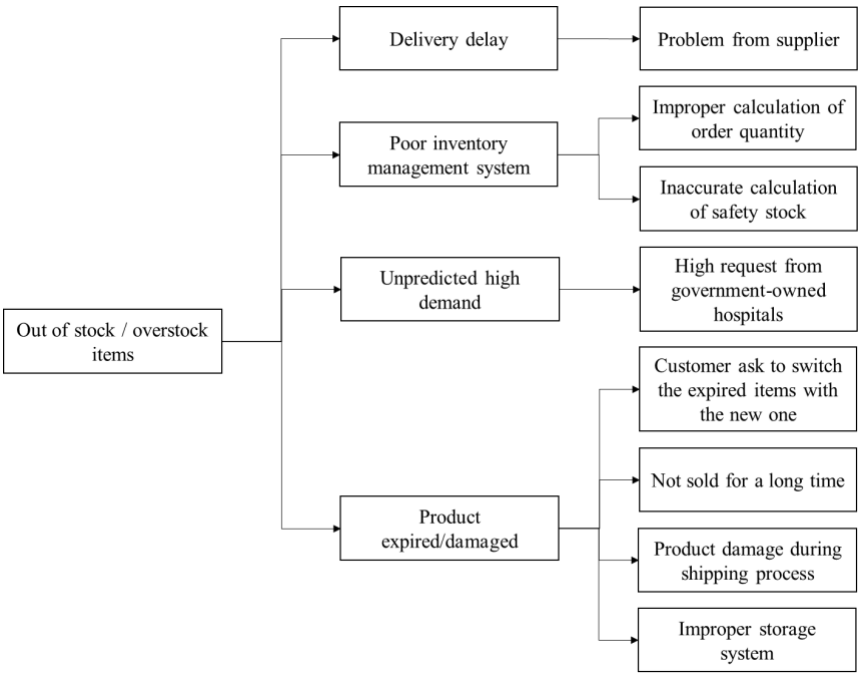

Figure 3: Tree Diagram for Stockout / Overstock Problem

The inventory management system is one of the essential things that must be considered by a business engaged in the distribution area. As explained in the previous chapter, currently PT. Medica Utama does not have any particular system related to its inventory management. The safety stock amount and order quantity are calculated manually based on the previous year's demand history. In this case, improper and inaccurate of the order quantity and safety stock can be considered the secondary cause of the inventory management problem. By looking for the right calculation method, the problem determining the amount of safety stock and order quantity can be resolved. It is expected to increase the efficiency of ordering costs.

The demand for medical devices can fluctuate depending on health and environmental conditions in the surrounding community. Some government hospitals (RSUD) that have an annual budget often placed sudden orders in large numbers to spend the government's budget. The number of requests from RSUD is uncertain, depending on the remaining budget they have left at the end of the year. These sudden requests can also be the primary cause of unpredicted high demand, which is also categorized as an uncontrollable condition.

The last problem factor is product is expired or damaged, which can happen if a stock has not been sold in a long period until it reaches the expiration date. If it has expired, the item must be discarded since it is not sterile anymore. Moreover, some customers who have expired items have asked to exchange with the new one. PT. Medica Utama usually fulfils this request by submitting several requirements to bind the customer as one of company's marketing strategies. Other secondary factors are product damage during the delivery process, and improper storage systems can also cause damaged product.

Results and Discussion

Items Classification

The total demand during 2019 until mid-2020 is 475 units. Based on ABC classification, there are 67 items in class A (80% from total dollar value), 152 class B (15% from total dollar value), dan 255 class C (5% from total dollar value). Dollar value calculate by multiplying the items total amount and unit price then divide by the total price. The classification of all items (Class A, B, and C) in the form of a pareto diagram is illustrated in the following graph:

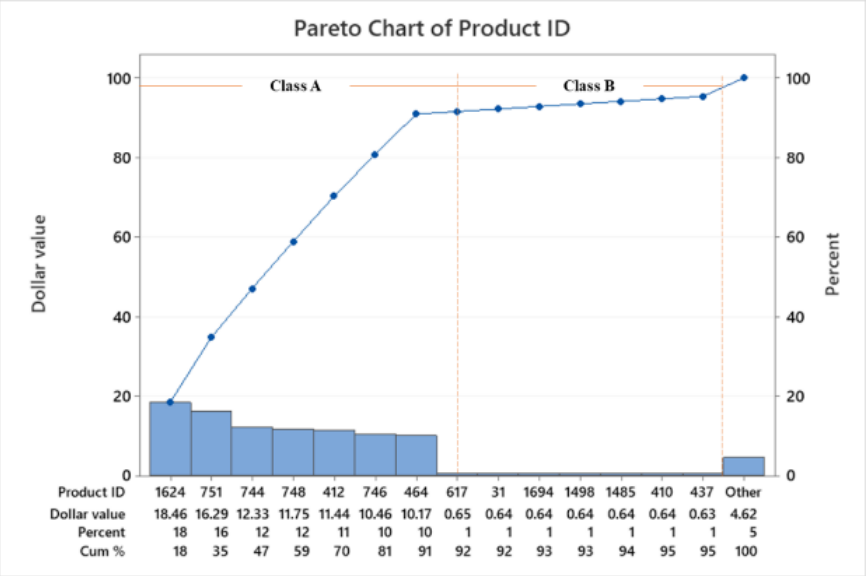

Figure 4: Pareto Chart of Demand for Period 2019 until August, 2020

Demand Forecast

After obtaining the grouping of items based on pareto, the next step is to simulate the estimated demand in September 2020 for all items from class A using Minitab software. There are four methods forecasting used, namely, Single and Double Exponential Smoothing, Moving Average, and Trend Analysis.

Table 1: September Demand Forecasting Result – Single and Double Exponential Smoothing

Product ID	Single Exponential Smoothing			Double Exponential Smoothing		
	Sept - F	MAPE	MAD	Sept - F	MAPE	MAD
1624	356	160.9	225.3	476	105.7	229.3
751	1,322	104.0	687.0	1,472	80.0	791.0
744	1,278	70.0	611.0	1,427	55.0	651.0
748	1,234	66.0	548.0	1,006	63.0	575.0
412	435	63.4	247.5	388	59.3	249.2
746	1,170	70.0	446.0	944	77.0	510.0
464	155	148.8	119.5	116	138.3	113.9
406	450	47.4	165.6	455	43.8	164.2
750	365	141.0	416.0	206	133.0	389.0
771	195	194.0	159.4	154	184.3	160.2
1459	63	103.1	61.5	29	90.6	59.6
414	179	86.6	88.9	146	82.5	89.9
1458	62	77.3	55.9	38	67.5	55.4
407	152	42.3	81.9	122	38.8	76.4

Table 2: September Demand Forecasting Result – Trend Analysis and Moving Average

Product ID	Trend Analysis Regression			Moving Average		
	Sept - F	**MAPE**	**MAD**	**Sept - F**	**MAPE**	**MAD**
1624	346	164.1	211.5	238	174.0	268.0
751	1,295	89.0	686.0	1,260	123.0	812.0
744	1,429	64.0	641.0	1,227	83.0	704.0
748	1,374	63.0	604.0	1,299	71.0	517.0
412	457	51.4	217.9	407	75.3	261.3
746	1,529	58.0	492.0	1,054	76.0	479.0
464	185	143.1	102.7	190	147.0	113.5
406	442	45.8	160.5	441	54.5	181.0
750	358	121.0	351.0	391	167.0	458.0
771	173	158.9	134.4	203	205.6	141.6
1459	28	85.4	54.0	65	111.4	64.6
414	141	76.5	69.6	213	105.6	99.6
1458	36	60.2	46.2	71	80.8	58.6
407	122	31.2	66.5	168	43.4	84.2

Summarizing the forecasting methods (shown in Table 1), with example of item number 1624, the model using Trend Analysis has the lowest value, which is 164.10 for Mean Absolute Percentage Error (MAPE) and 211.50 for Mean Absolute Deviation (MAD), compare with Exponential Smoothing and Moving Average methods. Since the two measurements are indicated forecast error and evaluate forecast model, thus the lower the value, the more accurate the forecast is. Although each item has different error value for each forecasting method, however, the overall results out of a total 67 items in class A, most of the items have the lowest error in the Trend Analysis method. Therefore, the calculation of order quantity and safety stock will use Trend Analysis results, including forecast for average demand and standard deviation.

Safety Stock and Order Quantity

Between the two models of inventory management, Fixed-Time Period Model (P-Model) is considered as the most appropriate method according to the company's conditions, which are: number of orders vary in each order placement depending on the demand history and availability item in warehouse (safety stock); inventory is being checked in every review period, which is once per three months; company has a wide variety of items (up to 1,000 items); and purchase several types of items in every ordering time.

Hence, safety stock and order quantity calculation are conducted based on the formula of fixed-time period mode. For example, below is the calculation of safety stock and order quantity for item number 1624, using forecast data based on the trend analysis result and complete with the company's data. Below is the data example of item number 1624, review period is same for all item, while others can be varied (such as average lead time, monthly demand, standard deviation, and inventory level. With 3-month review period, amount of safety stock and order quantity are shown in Table 3.

Table 3: Result Example of Safety Stock and Order Quantity based on Fixed-time Model

Product ID	Lead Time	Inv. Level	Avg. Demand	St. Dev	Safety Stock	Order Quantity
1624	1.44	300	327.46	311.02	1,075	1,575
771	1.28	262	159.89	178.08	604	706
1459	2.21	227	20.17	89.77	336	174
477	1.27	0	38.10	32.27	109	196
1458	2.34	250	28.66	86.18	327	173

Inventory Status and Cost Saving

PT. Medica Utama reviews inventory once in three months, then places order for items that have entered the minimum limit. There is no particular method for deciding the minimum limit, only determined manually by the company's owner. Comparison of the inventory conditions of PT. Medica Utama with the ideal amount, which is determined from the calculation of safety stock (include lead time consideration) can be seen on Table 4.

Table 4: Comparison between Actual Stock and Fixed-Time Model

Product ID	Current Stock (Actual)	Safety Stock (Fixed-Time model)	Gap stock	Status
1624	300	1,075	-775	Understock
751	9,630	3,622	6,009	Overstock
744	5,602	3,238	2,364	Overstock
748	4,932	2,843	2,089	Overstock
406	2,852	531	2,321	Overstock
750	8,172	2,211	5,961	Overstock
771	262	604	-342	Understock
1459	227	336	-109	Understock
414	1,368	109	-109	Understock
1458	250	327	-77	Understock

Using the assumption that half of the total safety stock will be used to meet demand, then using the formula in previous section, the expected Average Inventory Level (AIL) on hand shown in Table 3. It can be seen that the actual AIL in the company is much higher than the AIL from theory calculation. Those results implied that the company fails to predict short-term demand in the next period, affecting the order quantity planning for each item. In accordance with the results of the comparison between the actual inventory level and the theory (ideal), a calculation is made for the possible savings obtained by PT Medica Utama, namely by looking at the gap between the actual and theoretical inventory value (using fixed time model). The detail estimation of potential savings is carried out for each item and the overall item in classification A is available on Table 5.

Table 5: AIL Value of Money

Status	Actual	Fixed-Time Model	Gap
Overstock	$ 1,137,464	$ 420,331	$ 717,133
Understock	$ 113,397	$ 189,602	$ (76,205)
Total AIL	$ 1,250,861	$ 609,933	$ 640,928

Conclusion

This study shows the importance of demand forecasts in inventory management to provide precise determination of the number of orders, so as to reduce the possibility of overstock and stockout. Forecasting method can generate a different error value for each item depending on demand fluctuations per month. It is important for the company to do recording for each month demand in order to get better insight of future planning. The method suggested in this study can be used for unstable demand conditions without seasonal pattern. Simulation and calculation using class A items as representative, however the formulas and series of processes carried out can also be applied to items in class B and C.

In this research, both forecasting method and inventory management model, are not considering the expiration date for calculation due to lack of data resource. For further research related to the health sector, it is expected to be able to analyze expiration date for each item for the better purchasing planning.

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